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SPECIFICATION FOR EXTRA LOW VOLTAGE AND LOW VOLTAGE SPRING RETURN NON-LATCH SWITCHES FOR AIRCRAFT

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Indian Standard

SPECIFICATION FOR EXTRA LOW VOLTAGE AND LOW VOLTAGE SPRING RETURN NON-LATCH SWITCHES FOR AIRCRAFT

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Indian Standard

SPECIFICATION FOR EXTRA LOW VOLTAGE AND LOW VOLTAGE SPRING RETURN NON-LATCH SWITCHES FOR AIRCRAFT

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 27 October 1978, after the draft finalized by the Aircraft Electrical Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 In the preparation of this standard assistance has been derived from BS G. 145 : 1954 'Extra low voltage and low voltage spring return non-latch switches', issued by the British Standards Institution.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of hand-operated or mechanically-operated switches, spring-loaded to return, for use on aircraft systems of 28 V dc and 115/200 V ac at 400 Hz.

1.2 This standard does not apply to switches mechanically or electrically latched in the operated position.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

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*Rules for rounding off numerical values (*revised*).

2.1 Extra Low Voltage — Voltage not exceeding 32 V between conductors, and conductor and earth.

2.2 Low Voltage — Voltage not exceeding 250 V under normal conditions.

2.3 Type Tests — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general qualities and design of a given item.

2.4 Acceptance Tests — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

2.5 Routine Tests — Tests carried out on each item to check the essential requirements which are likely to vary during production.

3. DESIGN AND CONSTRUCTION

3.1 Contact Arrangement — The switch may have one or more pairs of contacts so arranged that they are normally closed, normally open, or a combination of normally open and normally closed contacts. The contacts shall be self-cleaning or corrosion resistant.

3.2 General Construction — The switch shall be sound, suitable for its purpose and its design and construction shall comply with 'Indian Standard General requirements for electrical equipment and indicating instruments for aircraft' (*under preparation*).

3.3 Operation — The actuating mechanism shall be so arranged that when normally operated and released no contacts shall be incompletely made or incompletely broken. Compression springs shall preferably be used. Fracture of any spring shall not prevent the contacts from returning to their normal operating conditions, on removal of the operating pressure. The force required to operate the switch shall be stated by the manufacturer. Mechanically operated switches should preferably operate with a quick make and break action irrespective of the rate of action of the switch.

3.4 Terminals — The terminals should preferably be capable of accommodating two cables appropriate to the rating of the switch.

3.5 Vibration, Acceleration, Climatic Proofing and Flame-Proofing — The design and construction of the switch shall be such as to meet the requirements of relevant Indian Standards in respect of the following:

a) Vibration,
b) Acceleration,

c) Climatic test, and

d) Flame-proof enclosure.

NOTE — Till such time Indian Standards on environmental tests for aircraft equipment are made available, the requirements for the above tests shall be subject to agreement between the manufacturer and the purchaser.

4. MARKING

4.1 Each switch shall be clearly and indelibly marked with the following information:

a) Number of this Indian Standard, IS:.........;

b) Manufacturer's name and identification;

c) Manufacturer's type number; and

d) Ratings in amperes and volts, ac or dc.

4.1.1 The switches may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5. TESTS

5.1 General — Unless otherwise specified, the tests shall be made in an ambient temperature of 22 to 32°C. Connecting cables not less than 60 cm long of the smallest size appropriate to the rating of the switch, shall be used together with suitable cable terminations where applicable. The force applied to operate the switch throughout the tests shall be that stated by the manufacturer, in accordance with the requirements of **3.3**.

5.1.1 In all tests, each pair of contacts shall be loaded according to the requirements of the tests.

5.2 Classification of Tests

5.2.1 *Type Tests* — The following shall constitute the type tests and shall be made on representative samples of each particular design and size of the switch:

a) Vibration, acceleration and climatic proofing (**5.3**),

b) Test of flame-proof enclosure (**5.4**),

c) Overload (**5.5**),
d) Temperature-rise (**5.6**),
e) Endurance (**5.7**),
f) High voltage and insulation (**5.8**),
g) Mechanical operation (**5.9**), and
h) Voltage drop (**5.10**).

5.2.1.1 The tests specified in **5.3** shall be performed on the same switch in the order indicated but the tests specified in **5.4** to **5.10** may be carried out on another switch or switches.

5.2.2 *Acceptance Tests* — The following shall constitute the acceptance tests:

a) Endurance (**5.7**),
b) High voltage and insulation (**5.8**),
c) Mechanical operation (**5.9**), and
d) Voltage drop (**5.10**).

5.2.2.1 *Number of samples and criteria for acceptance* — A recommended sampling scheme for acceptance is given in Appendix A.

5.2.3 *Routine Tests* — The following shall constitute the routine tests and shall be carried out on each switch:

a) High voltage and insulation (**5.8**),
b) Mechanical operation (**5.9**), and
c) Voltage drop (**5.10**).

5.3 Vibration, Acceleration and Climatic Proofing — The switch shall be subjected to the appropriate vibration test, acceleration test and to the cycles of temperature, pressure and humidity specified in the relevant Indian Standard (*see* Note under **3.5**).

5.3.1 The functioning tests specified in the vibration, acceleration and climatic tests in the relevant Indian Standards shall each consist of 60 operations of the switch, make and break, at approximately 15 operations per minute controlling a load equivalent to its normal rated current and of negligible inductance at its normal rated voltage and frequency.

5.4 Test of Flame-Proof Enclosure — The switches shall be subjected to the test of flame-proof enclosure specified in the relevant Indian Standard (*see* Note under **3.5**).

5.5 Overload Test — The switch shall perform 50 make and break operations, at a rate of 2 to 3 operations per minute, with a load of negligible inductance at 200 percent normal rated current at each appropriate rated voltage. The voltage drop across the terminals at the normal rated current shall not exceed 100 mV.

5.6 Temperature-Rise Test — The switch shall be connected up as described in **5.1** and shall be shielded from extraneous air currents.

5.6.1 After carrying normal rated current for one hour the temperature-rise of any part of the switch shall be lower than that at which any deterioration is liable to affect adversely the declared life of the switch or its performance.

5.6.2 The temperature-rise of any part which is necessarily handled and which is made from material which is a poor thermal conductor shall not exceed 20°C. Where such a part is made from metal the temperature-rise shall not exceed 10°C.

5.7 Endurance Test

5.7.1 The switch shall perform 5 000 operations satisfactorily at a rate of approximately 15 operations per minute, controlling a load of 1 A and 0·6 H inductance at 28·0 V dc.

5.7.2 Following the test given in **5.7.1**, the switch shall perform 2 500 operations satisfactorily at approximately 15 operations per minute, controlling a load equivalent to its normal rated current and of negligible inductance at its normal rated voltage and frequency.

5.7.3 The switch shall then perform 2 500 operations satisfactorily at a rate of approximately 15 operations per minute controlling a load equivalent to its normal rated current and of negligible inductance at its normal rated voltage and frequency at an atmospheric pressure equivalent to an altitude of 12 200 metres.

5.7.4 No adjustments to the mechanism or contacts shall be made. The voltage drop across the terminals, per pair of contact in series at the normal rated current, and measured before and at regular intervals throughout the test shall not exceed 100 mV.

NOTE — It is preferable to use air-cored coils for the inductive loads. Where a ferro-magnetic circuit is used, the inductance values shall be measured using a direct current of the appropriate value.

5.7.5 Upon completion of the tests specified in **5.7.1** to **5.7.4** the switch shall be subjected to a high voltage and insulation resistance test in accordance with **5.8**.

5.7.6 The switch shall then be stripped and examined. There shall be no undue deterioration of any part.

5.8 High Voltage and Insulation Resistance Tests

5.8.1 A test voltage of 1 500 Vrms at 50 Hz shall be applied for one minute between the terminals with the switch open.

5.8.2 If the case is of metal, the test voltage shall be applied for one minute between each of the terminals connected together and the case with the switch open and closed.

5.8.3 When an all-insulated case is used, the switch shall be mounted on a metal panel in a manner similar to that in which it will be used, for example, registering in a hole or recess for flush mounting or on the face of the panel for surface fixing. The test voltage shall be applied between the terminals connected together and the panel with the switch open and closed.

5.8.4 Immediately following each test in **5.8.1** to **5.8.3**, the insulation resistance shall be measured with a source of 500 V dc. The insulation resistance shall be not less than 100 MΩ.

5.9 Mechanical Operation — Every switch shall be tested to prove that it can be satisfactorily operated in compliance with **3.3**. The force required shall be within ± 20 percent of that stated by the manufacturer.

5.10 Voltage Drop — The voltage drop across the terminals at the normal rated current shall not exceed 100 mV per pair of contacts in series.

APPENDIX A

(*Clause* 5.2.2.1)

SAMPLING PROCEDURE FOR ACCEPTANCE TESTS

A-1. LOT

A-1.1 In any consignment, all switches of the same make, rating and type and manufactured under similar conditions of production shall be grouped together to constitute a lot.

A-2. SELECTION OF SAMPLE

A-2.1 The number of switches to be selected from the lot shall depend upon the size of the lot and shall be in accordance with col 2 of Table 1. All the switches so selected shall be subjected to the acceptance tests specified in **5.2.2**.

TABLE 1 SAMPLE SIZE AND CRITERION FOR CONFORMITY

(*Clauses* A-2.1, A-3.1 *and* A-3.2)

LOT SIZE (1)	FIRST SAMPLE N_1 (2)	SECOND SAMPLE N_2 (3)	ACCEPTANCE NUMBER C_1 (4)	REJECTION NUMBER C_2 (5)
Up to 50	5	10	0	2
51 ,, 100	7	14	0	2
101 ,, 200	10	20	0	3
201 ,, 300	13	26	0	3
301 ,, 500	20	40	1	4
501 and above	25	50	1	5

A-3. CRITERION FOR CONFORMITY

A-3.1 The lot shall be considered as conforming to the requirements of acceptance tests if the number of failures in the first sample is less than or equal to acceptance number C_1 given in col 4 of Table 1. If the number of failures is greater than or equal to the rejection number C_2 as given in col 5 of Table 1, the lot shall be considered as not conforming to the requirements of the acceptance tests.

A-3.2 If the number of failures is beween C_1 and C_2, a further sample of N_2 switches shall be selected and subjected to the acceptance tests. If the number of failures in the two samples combined is less than C_2 the lot shall be considered as conforming to the requirements of the acceptance test, otherwise not.